INITIAL STUDIES OF INDIRECT CYTOTOXICITY OF Ti-25Ta-WT%Zr ALLOYS

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1. Introduction

The most commonly used Ti-based alloy for production of prostheses and special medical/dental devices is Ti-4Al-4V alloy [1]. However, recent studies have been shown that vanadium and aluminum are associated to cytotoxic effects that are responsible – adverse reactions in tissues and neurological disorders, respectively [2]. The promising alloys containing different wt% niobium (Nb), tantalum (Ta), zirconium (Zr) and molybdenum (Mo) have been developed [3]. Thus, new alloys without these elements are being investigated as the Ti-20Ta-wt%Zr alloys, that are very promising. The purpose of this study was to verify the biocompatibility of these alloys without treatments.

2. Experimental

Sample Preparation: The samples used in this study were Ti-20Ta-wt%Zr alloys produced in an arc-melting furnace with refrigerated crucible. After melting, the samples were submitted to swaging in order to obtain cylindrical bars with diameters of approximately 6 mm. Ti-20Ta-wt%Zr disks were cleaned by sonication and autoclaved.

Cell Culture: MC3T3-E1 cells are a preosteoblastic lineage, obtained from calvaria of *Mus musculus* (ATCC, Rockville, MD, USA). Cells were grown in complete alpha-minimum essential medium (α-MEM, Invitrogen, Carlsbad, CA) supplemented with 10% fetal bovine serium (FBS), 1% gentamicin (Invitrogen) at 37ºC in humidified atmosphere with 5% CO_2.

In vitro cytotoxicity analysis (MTT): For indirect cytotoxicity, the extracts were obtained the alloys (1g/1mL) and then incubated at 37° C for 2, 3 and 7 days. MC3T3-E1 cells (density of 2 x 10^4 cell/well) were cultived on 96-well microplates and the base medium was replaced by their extracts of the alloys for 2, 3 and 7 days. The preparation was made for the absorbance reading. Glass was used as negative control, while a solution of α-MEM, 10% of FBS, and 1% of phenol was the positive control. The product was quantified spectrophotometrically by measuring absorbance at 562 nm using a microplate reader.

Micromorphological analysis: The cells were cultived (density of 2 x 10^4 cell/well) under the surface of the glass and the base medium was replaced by their extracts of the alloys for 2, 3 and 7 days. After these periods, the samples were prepared and examined in a EVO LS-15 scanning electron microscopy (Carl Zeiss). Base medium was used as negative control, while a solution of α-MEM, 10% of FBS, and 1% of phenol was the positive control.

3. Results and Discussions

The results demonstrated that wt% range did not interfere in vitro cytotoxity and the morphological results in all periods studied. In all cases, the absorbance levels – cytotoxicity analysis – were similar with presence of viable cells as negative control. SEM showed the cells exhibited well adhesion with numerous and long citoplasmatic process in all the tested extracts as well as the negative control. In summary, the present study showed that the Ti-20Ta-wt%Zr alloys are not cytotoxic for osteoblastic cells in culture.

4. References

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